Dispersion Technology Inc.

Characterization of Concentrated Dispersions and Emulsions, Liquids and Porous materials

Model DT-1202 Acoustic and Electroacoustic spectrometer: Particle sizing and Zeta potential measurement in concentrates.

Wide Range of Applications:

- Nanotechnology
- Colloid stability
- Ceramic slurries
- Cement slurries
- Battery slurries
- CMP slurries
- Cosmetics
- Paints and pigments
- Non-aqueous systems
- Clays and minerals
- Food emulsions
- Mixed dispersions
- Structured systems
- Photo materials

Model DT-1200 has two unique sensors: Acoustic and Electroacoustic.

Acoustic sensor characterizes ***particle size distribution*** by measuring ultrasound attenuation at set of frequencies from 1 to 100 MHz and sound speed. The same ultrasonic raw data can be used for calculating compressibility, elastic modulus and longitudinal viscosity of any liquid sample (when "Rheological option" is installed).

Electroacoustic sensor is built as a probe for measuring ***ζ-potential*** in concentrates without dilution. The same probe can be used for monitoring sedimentation kinetics and for characterizing porous materials (when "Porous materials option" is installed).

These sensors can function either separately for individual measurements, or together, providing certain synergism in sample characterization.

Available Options:

Titrations option with one or two burettes allows conducting of complicated experiments involving modification of chemical composition of the liquid medium according to a certain protocol. There are several different types of protocols available: "pH ramp", "pH stat", "surfactant titration", "temperature titration". Titration "pH ramp" allows scanning of a certain pH range in single or multiple sweeps and usually performed for determining isoelectric point. Titration "pH stat" monitors amount of a particular reagent that is required for maintaining given pH. Surfactant titration reflects changes in ζ-potential, particle size distribution, or both, with incrementally increasing surfactant concentration. It is used for determining optimum surfactant dose. Temperature titration requires installation of "heating control option", which would allow performing T sweeps within a range from room T up to 50 C.

Conductivity aqueous option allows for measuring electric conductivity of aqueous systems within a range from 10^{-3} to 10 S/m. This probe functions at MHz range and, consequently, is not affected by electrode polarization. The same probe is used for measuring porosity of a porous material if Porous materials option is installed.

Conductivity non-aqueous option allows for measuring conductivity of various solvents including non-polar liquids within the range from 10^{-11} up to 10^{-4} S/m. This option is identical in function to the DT-700 model. This option requires installation of "non-aqueous media option", which is important for protecting instrument sensor from aggressive solvents if they are intended to be used.

Rheological option allows calculation of high frequency (MHz range) longitudinal rheological parameters such as compressibility, elastic modulus, viscosity, and performs test on Newtonian nature of the liquid sample.

Porous materials option allows characterization of porosity using the aqueous conductivity probe, as well as pore size and zeta potential of a porous material with electroacoustic probe. Characterization of these last two parameters would require calibration.

External pump option is required when viscous samples are monitored continuously, which can serve as a laboratory prototype for on-line characterization.

Nominal Specifications:			
Calculated parameters		**Sample volume, minimum [ml]**	
Mean size [microns]	0.005-1000	Size only	15
Zeta potential [mV]	±(0.5%+0.1)	Zeta only	0.1
Weight fraction / porosity	±0.1%	Both, no sedimentation	15 +0.1
Compressibility E10 [1/Pa]	±0.003	Both with mixing	70
Bulk viscosity [cP]	±0.01	Both with titration	110
Debye length [nm]	±0.1	Both with pumping	150
Measured parameters		**Sample requirements**	
Temperature [C 0]	0 to 100, ±0.1	Volume fraction, % (1)	0.1-50
pH	0.5-13.5, ±0.1	Conductivity	none
Frequency range [MHz]	1-100	pH	0.5-13
Ultrasound attenuation [dB/cm/MHz]	0 to 20, ±0.01	Temperature [C0]	<50
Sound speed [m/sec]	500 to 3000, ±0.1	Viscosity of media [cP] (2)	<20,000
Ellectroacoustic signal [mV(s/g)1/2]	±1%	Viscosity of sample [cP]	<20,000
Conductivity [S/m]	10^{-11} to 1, ±1%	Particle size [microns]	0.005-1000
Measurement time [min]	0.5-10	Zeta potential [mV]	none

(1) Instrument can measure attenuation well above 50% vl, but verification of the theory for computing particle size and zeta potential is not possible above this limit.

(2) The "micro-viscosity" is important for theoretical calculation. It might be different than "macroscopic" viscosity for gels and other structured systems measured with conventional rheometers.

Physical Specifications. Electronic unit: weight 20 kG, sensor unit 30 kG. Power: 100-250 VAC, 50-60 Hz, <300 W. Software: embedded Windows HP, MS Office optional

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